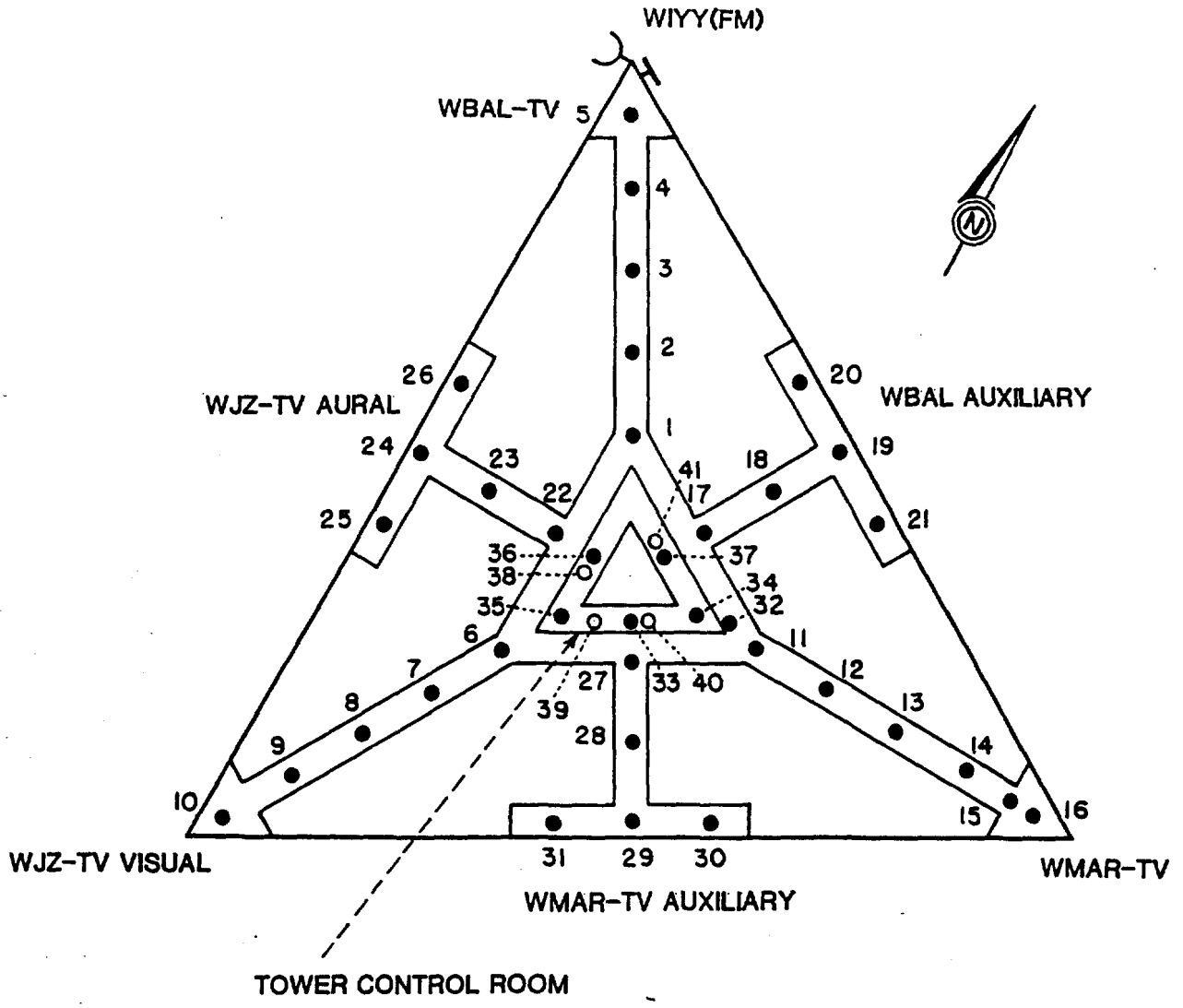
COHEN, DIPPELL and EVERIST, P.C. Consulting Engineers Washington, D.C.

FIGURE 1



o ON SECOND PLATFORM

RF RADIATION

MEASUREMENT POINT LOCATIONS

TTI TOWER

BALTIMORE, MARYLAND

MARCH 1989

COHEN AND DIPPELL, P. C.

ENGINEERING REPORT
RE DETERMINATION OF RF RADIATION LEVELS
ON TTI TOWER
BALTIMORE, MARYLAND
APRIL 1986

COHEN AND DIPPELL, P. C.

City of Washington)
)ss
District of Columbia)

Julius Cohen, being duly sworn upon his oath, deposes and states that:

He is a graduate electrical engineer, a Registered Professional Engineer in the District of Columbia, and President of Cohen and Dippell, P.C., Consulting Engineers,

COHEN AND DIPPELL, P. C.

City of Washington)
) ss
District of Columbia)

Sudhir K. Khanna, being duly sworn upon his oath, deposes and states:

That he is a graduate electrical engineer, a registered professional engineer in the District of Columbia, and is employed by the firm of Cohen and Dippell, P.C., Consulting Engineers, Radio - Television, with offices at 1015 15th Street, N.W., Suite 703, Washington, D.C. 20005;

That he assisted in the making and analysis of the measurements;

That the facts stated herein are true of his own knowledge, except such facts as are stated to be on information and belief, and as to such facts, he believes them to be true.

S.K. Khanna

Sudhir K. Khanna
District of Columbia
Professional Engineer
Registration No. 8057

Subscribed and sworn to before me this 3rd day of April, 1986.

Notary Public

My Commission Expires:

February 28 1989

CAROLYN L. COTCHIN NOTARY PUBLIC DISTRICT OF COLUMBIA

This engineering report has been prepared on behalf of Television Tower, Inc. ("TTI") to provide the results of broadband RF radiation measurements made on and in the vicinity of its candelabra tower located at 3800 Hooper Avenue in Baltimore, Maryland. The measurements were made on March 5, 1986, between the hours of 11 a.m. and 4:30 p.m. The weather was partly sunny, windy, and the temperature in the mid thirties.

TTI tower supports antennas for three VHF TV stations, two FM broadcast stations and number of other various communication operations. The attached Table I lists the FCC authorized facilities of each TV and FM broadcast station located on the tower.

Non-ionized RF radiation is commonly measured with a broadband field strength meter using isotropic electric and magnetic probes. The broadband field strength meters provide the combined RF field of all signals at the measuring location within the meter's frequency range. The isotropic broadband field strength meters used for the TTI tower measurements were manufactured by Holaday Industries, Inc., Eden Prairie, Minnesota. Two isotropic broadband meters, Holaday, Model HI-3001, Serial Number 33263 and Model HI-3004, Serial Number 39179 were used in the survey. Model HI-3001 was calibrated on

August 8, 1983. This meter was returned to the manufacturer for check of calibration on March 17, 1986, which verified the prior accuracy of calibration. Meter HI-3004 was calibrated on February 5, 1985. The meter, HI-3001, depending on the probe used, measures the electric field in V^2/m^2 and magnetic field in A^2/m^2 while Model HI-3004 measures electric field in V/m. The measured value in far field areas can be converted into equivalent power density by applying the impedance of free space (377 ohms). Three different probes were used with Model HI-3001 depending on the range of measured field and whether electric or magnetic field were measured. The design of E-field probe is based on the diode-dipole antenna developed by the National Bureau of Standards, Boulder, Colorado. The probe consists of three mutually orthogonal diode-dipoles to provide an isotropic response. That is, the total field strength at the meter is displayed regardless of the field orientation or probe receiving angles. Model HI-3001 covers the frequency range of 0.5 mHz to 6000 mHz while Model HI-3004 covers the frequency range of 0.5 mHz to 3000 mHz. All TV and FM stations located on the tower operate within the frequency range of both meters.

The magnetic field strength was measured with the Holaday meter HI-3001 using the magnetic probe STH-01. At several

locations on the top platform of the tower, the meter did not record any magnetic field. At other locations the level of magnetic field strength were found to be low except at two locations near WMAR-TV main antenna.

The electric field strength measurements were made at several locations on the top platform of TTI candelabra and also on a platform located at 300 foot level. The measurements on microwave platform at 638 foot level were made on September 26, 1985. Measurements were also made in the tower elevator near WMKR-FM antenna. Those measurements are attached to this report as Appendix A. The measurements were made on catwalks leading to each antenna platform and inside the tower control and equipment room located on top platform of the tower. Measurements were also made on the second platform in this room. The attached Table II lists the measured electric and magnetic field strengths recorded on the tower and the equivalent RF power density.

Table III lists the magnetic field strengths measured on the tower. The magnetic field strengths were higher at two locations and exceeded the ANSI standards. These locations are on the platform under the main WMAR-TV antenna and near the second brace on the catwalk leading to the main WMAR-TV antenna.

At seven locations on the tower the electric field exceeded the ANSI standard of 4000 V^2/m^2 which is equivalent to 1 mw/cm^2 in power density. (This is the standard which was adopted by the FCC for frequencies in the range of 30 to 300 mHz.) The highest electric field was observed on the platform immediately under the main WMAR-TV antenna. Under the other TV antennas at similar locations, the electric field strengths were higher than the ANSI standard. At three other locations on the catwalk leading to WMAR-TV antenna, the electric field was observed higher than 4,000 V^2/m^2. The electric field also exceeded this value on the left side of the antenna platform near WBAL-TV auxiliary antenna.

The attached sketch (Figure 1) shows the measurement point numbers 5A, 10, 15, and 16, located under the three main TV antennas where electric field exceeded the ANSI standards. Similarly, measurement point numbers 13 and 14 located on the main WMAR-TV catwalk and point 20 on WBAL-TV auxiliary antenna platform recorded higher electric field than the ANSI standard. At measurement point numbers 13 and 16 on the main WMAR-TV antenna catwalk the magnetic field was observed higher than the ANSI requirement.

The measured electric field strength was below the ANSI standard in the tower control room and at the remaining

platform locations on top of tower. The electric field strength measured on the platform at the 300 foot level was also substantially less than 1 mw/cm^2 as shown on Table II.

RF radiation measurements were also made at several locations on the ground in the vicinity of the TTI tower. These locations included the area around the three TV stations transmitter buildings, driveways, and the nearest residential street. The Holaday meter HI-3004 was used for these measurements due to the expected low values. Table IV lists the electric field strenghs measured in V/m in the vicinity of tower. As expected the RF measured values were substantially below the ANSI standard of 61.4 V/m (1000 uw/cm^2). The observed values on the ground were for less than any recognized present or proposed radiation standard in the country. In Table IV the electric field strengths have been converted to equivalent power density unit of microwatts per square centimeter (uw/cm^2) rather than milliwatts per square centimeter (mw/cm^2) because of the low values.

The main contributing factors of RF energy levels on and in the vicinity of tower are due to the operation of TV and FM broadcast stations. The FM signal and the TV peak visual and aural signals are more or less constant. Therefore, there is no reason to expect that the readings would be significantly different on any other day.

The attached Table V shows the complete ANSI standards for frequencies ranging from 0.3 mHz to 100,000 mHz. The ANSI standards are for power densities not to be exceeded averaged over any six minute period.

According to ANSI, a higher level of RF exposure than 1 mw/cm^2 can be tolerated for lesser period of time than six minutes. For example, exposure to 6 mw/cm^2 power density can be tolerated for 1 minute. The highest electric field observed in the entire survey was under 4 mw/cm^2. Except for locations immediately under the main TV antennas and three other locations on the catwalks, all exposure levels were below 1 mw/cm^2. The highest value on the catwalks was 1.5 mw/cm^2. Walking through the catwalks, an individual would not be exposed to above ANSI radiation levels considering the time of passage. Similarly riding the elevator with the door open would not expose an individual to above ANSI standard radiation [illegible] with the door closed [illegible] below ANSI

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TABLE I

LIST OF BROADCAST STATION'S ANTENNAS
LOCATED ON TTI TOWER
BALTIMORE, MARYLAND

Call	City/State	Channel (Frequency) mHz		ERP kW	AHAAT Feet	(Meters)
WMAR-TV	Baltimore, MD	2	(54-60)	100	1000	(305)
WBAL-TV	Baltimore, MD	11	(198-204)	316	1000	(305)
WJZ-TV	Baltimore, MD	13	(210-216)	316	990	(302)
WIYY(FM)	Baltimore, MD	250	(97.9)	10.5 DA	952	(290)
WMKR(FM)	Baltimore, MD	293B	(106.5)	24	722	(220)

TABLE II

BROADBAND RF RADIATION MEASUREMENTS
ON TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 1)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3001

Point No.	Electric Field V^2/m^2	Equivalent Power Density mw/cm^2	Location
			WBAL-TV Main Antenna
1	950	0.252	entrance of catwalk
2	600	0.159	near 1st brace on catwalk
3	700	0.186	near 2nd brace on catwalk
4	1,300	0.345	near 3rd brace on catwalk
5	1,000	0.265	on platform under the main antenna
5A	10,000	2.653	on platform near the line (close to ladder) under the main antenna
			WJZ-TV Main Antenna
6	350	0.093	entrance of catwalk
7	420	0.111	near 1st brace on catwalk
8	450	0.119	near 2nd brace on catwalk
9	300	0.080	near 3rd brace on catwalk
10	10,000	2.653	on platform under the main antenna

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TABLE II

BROADBAND RF RADIATION MEASUREMENTS
ON TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 2)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3001

Point No.	Electric Field V^2/m^2	Equivalent Power Density mw/cm^2	Location
			WMAR-TV Main Antenna
11	700	0.186	entrance of catwalk
12	1,500	0.398	near 1st brace on catwalk
13	5,500	1.459	near 2nd brace on catwalk
14	5,700	1.512	near 3rd brace on catwalk
15	9,900	2.626	at the platform entrance
16	15,000	3.979	on platform under the main antenna
			WBAL-TV Auxiliary Antenna
17	500	0.133	entrance of catwalk
18	1,800	0.478	middle of catwalk
19	2,300	0.610	middle of antenna platform
20	4,500	1.194	left side of antenna platform
21	1,100	0.292	right side of antenna platform

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TABLE II

BROADBAND RF RADIATION MEASUREMENTS
ON TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 3)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3001

Point No.	Electric Field V^2/m^2	Equivalent Power Density mw/cm^2	Location
			WJZ-TV Aural Antenna
22	950	0.252	entrance of catwalk
23	600	0.159	middle of catwalk
24	1,500	0.398	middle of antenna platform
25	1,000	0.265	left side of antenna platform
26	950	0.252	right side of antenna platform
			WMAR-TV Auxiliary Antenna
27	880	0.233	entrance of catwalk
28	1,000	0.265	middle of catwalk
29	650	0.172	middle of antenna platform
30	750	0.199	left side of antenna platform
31	300	0.080	right side of antenna platform
32	750	0.199	WMAR-TV line coming out of tower control room

TABLE II

BROADBAND RF RADIATION MEASUREMENTS
ON TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 4)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3001

Point No.	Electric Field V^2/m^2	Equivalent Power Density mw/cm^2	Location
			Inside the Tower Control Room
33	150	0.040	across from WMAR-TV auxiliary antenna
34	250	0.066	near WMAR-TV line
35	250	0.066	near WMAR-TV controls
36	250	0.066	across from WJZ-TV aural antenna
37	200	0.053	across from WBAL-TV auxiliary antenna
			On Second Platform Inside Tower Control Room
38	200	0.053	across WJZ-TV aural antenna
39	150	0.040	back of cabinet
40	320	0.085	across from WMAR-TV auxiliary antenna
41	300	0.079	across from WBAL-TV auxiliary antenna

TABLE II

BROADBAND RF RADIATION MEASUREMENTS
ON TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 5)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3004

Point No.	Electric Field V/m	Equivalent Power Density mw/cm^2	Location
			Platform at 300 Feet Level
42	3.8	0.0038	facing north
43	4.8	0.0061	facing west
44	5.1	0.0069	facing east

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TABLE III

BROADBAND RF RADIATION MEASUREMENTS
ON TTI CANDELABRA TOWER
BALTIMORE, MARYLAND

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3001

Point No.	Magnetic Field A^2/m^2	Equivalent Power Density mw/cm^2	Location
5	0.005	0.189	on platform under WBAL-TV main antenna
10	0.005	0.189	on platform under WJZ-TV main antenna
12	0.005	0.189	near 1st brace to WMAR-TV main antenna catwalk
13	0.045	1.70	near the 2nd brace to WMAR-TV main antenna catwalk
16	0.04	1.51	on platform under WMAR-TV main antenna

TABLE IV

BROADBAND RF RADIATION MEASUREMENTS
IN THE VICINITY OF
TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 1)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3004

Point No.	Electric Field V/m	Equivalent Power Density uw/cm^2	Location
1	1	0.27	around the tower base
2	1.2	0.38	at the gate near tower
3	1	0.27	in front of gate WJZ-TV studio driveway
4	2.8	2.10	driveway leading to studio garage
5	2.9	2.23	in front of garage
6	2.3	1.40	WJZ-TV studio right side parking lot
7	3	2.39	far end of parking lot
8	4.2	4.68	in front of WJZ-TV studio right side of building
9	3	2.39	at the studio entrance
10	4.5	5.37	in front of WJZ-TV studio left side of building
11	3.8	3.83	WJZ-TV left side parking lot entrance
12	3	2.39	far left side of parking lot
13	3	2.39	far left back side of parking lot

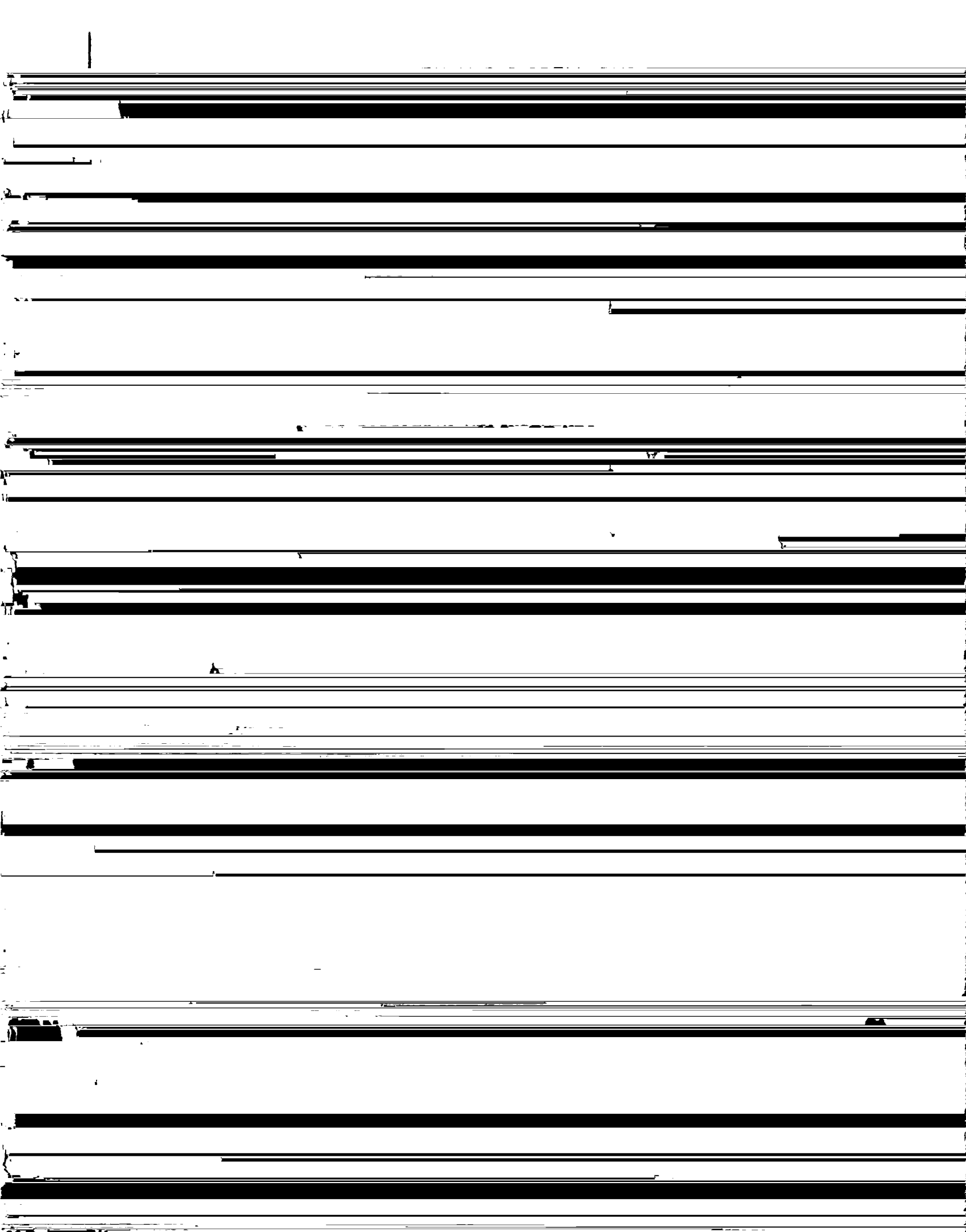

TABLE IV

BROADBAND RF RADIATION MEASUREMENTS
IN THE VICINITY OF
TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 3)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3004

Point No.	Electric Field V/m	Equivalent Power Density uw/cm^2	Location
26	4.5	5.37	3rd platform on steps
27	4.2	4.68	4th platform on steps
28	4	4.24	5th platform on steps
29	4.8	6.11	6th platform on steps
30	4	4.24	on top of steps
31	2.8	2.1	back of WMAR-TV transmitter building
32	4.5	5.37	WBAL-TV studio back door on platform
33	1.2	0.38	WMAR-TV transmitter entrance
34	2.7	1.93	WMAR-TV parking lot entrance
35	5.5	8.02	WBAL-TV studio parking lot opposite main entrance
36	6.6	11.55	WBAL-TV studio front steps
37	4.2	4.68	WBAL-TV studio on the landing in front of main entrance
38	5.2	7.17	WBAL-TV studio news truck parking lot

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TABLE IV

BROADBAND RF RADIATION MEASUREMENTS

TABLE IV

BROADBAND RF RADIATION MEASUREMENTS
IN THE VICINITY OF
TTI CANDELABRA TOWER
BALTIMORE, MARYLAND
(Page 5)

Date: March 5, 1986
Meter: Holaday Industries, Inc.
Model: HI-3004

Point No.	Electric Field V/m	Equivalent Power Density uw/cm^2	Location
51	1.8	0.86	at the intersection of Hooper Ave. and Rock Rose Ave. NE corner
52	1.4	0.52	SE corner of intersection
53	2.0	1.06	SW corner of intersection
54	2.2	1.28	NW corner of intersection
55	4.5	5.37	backyard of white house top of Rock Rose Avenue
56	4.8	6.11	near 512872 pole on Rock Rose Ave.
57	5.6	8.32	at fire hydrant near Rock Rose Ave. and Keystone St.
58	4.5	5.37	at the intersection of Rock Rose and Keystone
59	3.3	2.89	opposite 2078 Rock Rose Ave.
60	3.1	2.55	opposite 2087 Rock Rose Ave.
61	2.7	1.93	opposite 2069 Rock Rose Ave.
62	2.6	1.79	across from 2069 Rock Rose Ave.

TABLE V

ANSI STANDARDS
RADIO FREQUENCY PROTECTION GUIDES

Frequency(f) mHz	Field Strength V^2/m^2	Field Strength A^2/m^2	Power Density uw/cm^2
0.3-3	400,000	2.5	100,000
3-30	4,000 $(900/f^2)$	0.025 $(900/f^2)$	$900/f^2$
30-300	4,000	0.025	1,000
300-1500	4,000 (f/300)	0.25 (f/300)	f/300
1500-100,000	20,000	0.125	5,000

APPENDIX A
RF RADIATION MEASUREMENT
MADE ON MICROWAVE PLATFORM
AT 638 FOOT LEVEL IN SEPTEMBER 1985
TTI TOWER, BALTIMORE

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BROADBAND FIELD STRENGTH MEASUREMENTS